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ABSTRACT

The situational and personal factors affecting the usage of a computer based information service by health care professionals are described. Of 166 health care professionals who were identified as potential users of MEDLINE at the University of Connecticut, 126 carried out one or more online searches. Pre-use and post-use questionnaires were administered to solicit information in the following areas: job profile, information needs, current use of information sources, satisfaction with information sources, experience with automated information systems, beliefs about computers and automated information systems, physical difficulty in using the system, and type of MEDLINE training received. It was concluded that the relevance of the information available to the immediate job-related problems of the user is the major determinant of the first use of the service. Total information needs, dissatisfaction with other sources of information, and beliefs about the satisfying nature of computer interaction and the reliability of computer machinery are predictive of more frequent use. This report is part of a National Institutes of Health (NIH) project carried out at five locations in the United States. (Author/THC)

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AN EXPLORATORY STUDY OF FACTORS AFFECTING USAGE OF AN ON-LINE COMPUTER-BASED BIBLIOGRAPHIC RETRIEVAL SERVICE

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ABSTRACT

An exploratory study of the situational and personal factors affecting the usage of a computer-based information service by health care professionals is described. The user population was free to use, or not to use, the service, and to use it as frequently as they chose. It is concluded that the relevance of the information to the immediate job-related problems of the user population is the major determinant of the first use of the service. Total information needs, dissatisfaction with other sources of information, and beliefs about the satisfying nature of computer interaction and the reliability of computing machinery are predictive of more frequent use.

AN EXPLORATORY STUDY OF FACTORS AFFECTING USAGE OF AN ON-LINE COMPUTER-BASED BIBLIOGRAPHIC RETRIEVAL SERVICE

INTRODUCTION

This paper describes an exploratory study. The objective of the study was to explore factors which might predict the usage and non-usage of a computer-based bibliographic information retrieval system, and for those who chose to use it, the amount of use they made of the system. It involves a population of users who are not normally oriented toward using computer systems.

The potential users of the service were not forced to use it to carry out their jobs. This situation is somewhat different from other studies of user acceptance of data retrieval systems. The information provided by the system described has varying value for different members of the potential user population. Some persons might find the ability to scan over a million journal entries quite central to their jobs. Other persons might need this service only rarely, if at all.

The service provided by the information retrieval system can also be obtained without the use of computers, at a good university library, for example. However, it requires much more time and effort to retrieve literature citations and abstracts manually, but this must be balanced against the time and effort required to learn to use the computer-based information service.

There are enough unique aspects to the setting and user population in this study to make confident predictions about user behavior impossible. For that reason, an exploratory approach

was taken.

To study the possible determinants of use of this system, a set of general factors which logically might affect usage patterns were developed. Specific questions about these factors were administered to the potential user population via a pre-use and a later post-use questionnaire.

The data analysis of these rather extensive measurements proceeded more from general speculations about what ought to affect usage of the service than from formal hypotheses. The data analyses presented in the latter part of this paper are thus more descriptive than inferential, but they may represent something of value to persons interested in providing information services for a population of users similar to those described below.

Some General Factors Which May Affect Use of Information Retrieval Systems

Physical Factors. The first requirement for use of a communication system based on computer hardware is physical access to the hardware. This very basic requirement is often assumed by those who study man-machine interaction. In a realistic situation, a user may have the choice of using some alternative to the computer information system. If the computer terminal is at a remote location, or if it is heavily used and the potential user must wait for access, the individual will probably be less likely to make use of the information system. The amount of use made of

the computer system is probably dependent on a simple time and information cost/benefit function. In the case of bibliographic citations, if a library with printed indices is closer, and if the user feels that enough information can be obtained from this source in a reasonably short time period, the person will probably not use the computer-based system.

Eason and Damodaran (1981) discuss this time minimization in the context of determining interaction system requirements for task-oriented users, but its effect extends to initial access, as well. Sackman (1970) also relates the time to learn to access information to the liklihood that use of the information will be made.

Benefit Factors. Another quite basic requirement of a computer-based communication system is that the potential user must have some need for the service provided. These systems are often developed with little knowledge of the real information needs of the user population, and then presented to the users after development is completed. If the service is subsequently not used, its failure may then be attributed to lack of "user-friendliness" or some other such structural factor, when in reality the service simply provides nothing that a potential user can use or could not obtain through other methods. Eason (1976) provides a very simple statement of this fact:

"The task the person is performing defines his interests in information at that time."

A new information system, and especially one which requires training to use, must solve some problem, or make some task

easier for potential users, for it to be accepted and used.

Satisfaction with Information Systems. This category is really made up of satisfaction with the information systems currently being used, and satisfaction with the information system being introduced.

The individual user's satisfaction with his current information collecting systems should predict usage. If the person is happy with the current system, there is no reason to expect that he/she will expend the energy and time to learn a new system. If he/she is unhappy with the status quo, we can expect more usage of the new system.

The other type of satisfaction has more to do with the user's personality. Malde, quoted in Eason and Damordaran (1981), made a distinction between "thing-oriented" and "people-oriented" individuals. "Thing-oriented" persons were more efficiency centered, and felt that working with computer systems was more personally satisfying that did "people-oriented" individuals. There is apparently some intrinsic satisfaction gained in using computers, beyond that of obtaining information from them, possibly because computers are seen as efficiency-enhancers.

Satisfaction of users with experience may also change. Gaines and Shaw (1983) state experienced users often report frustration with a seemingly rigid computer system. Hiltz and Turoff (1978) describe a similar phase in experienced users, which they called the "saturation phase". They describe it as being produced by the evolution of new information needs within

the user (partly because of experience with the current information system) which the system cannot meet. Satisfaction may thus be related to the general category discussed next, the user's prior experience with information retrieval systems.

Prior Experience. Coombs and Alty (1981) point out that most computer-based data systems function primarily as one-way information sources, and do not adapt to the needs of individual users. The effectiveness of this kind of system is dependent upon the level of the user's knowledge. Persons with prior experience with computers, and especially with similar information systems, might reasonably be expected to make more use of a computer-based system than would a novice computer user.

Beliefs about Computers. This area has received some attention. Sackman (1970) found that non-users felt that computer hardware was "unreliable and untrustworthy; ... software is unnaturally difficult and requires too much time and painstaking attention". Hiltz and Turoff (1978) document an apparently common belief that the computer will break if they do something wrong. During some pilot interviewing for this study, some individuals expressed beliefs that computers stifled creativity. Others showed a general distrust of machinery, including computers. This was often expressed as a "machines are out to get me" sentiment (the proposed name for this is the "Woody Allen Syndrome").

THE EXPLORATORY STUDY

These general factors may affect any user population's acceptance of a computer-based information service. This study was carried out to determine which of them operate in the specific setting of bibliographic information retrieval service available to a professional population, the members of which are naive or casual users of computer services.

The On-Line Service.

MEDLINE is a computer-based data retrieval system which contains information about professional literature of interest to health professionals. Typical information is a complete literature citation with author, journal, etc., and a short abstract of the article. The data base is maintained by the National Library of Medicine, under the administrative umbrella of the National Institutes of Health. Over 3000 journals are indexed under 25,000+ key terms. The data base contains over 1,000,000 entries, and is growing rapidly.

MEDLINE was designed to permit searches by persons familiar with medical terminology, but not expert in computer operations. However, each user must be able to operate a computer terminal, dial into a timesharing service, enter account numbers and passwords, etc. MEDLINE dialog is not a natural language system, so the user must also enter search requests in a fixed grammar, and must interpret sometimes cryptic responses from the system. MEDLINE is fairly typical of large data base information retrieval

systems in this respect. While the MEDLINE dialog is much easier to use than a formal data base language, it still would not be correct to call it "user-friendly".

To help new users, there is a rather extensive tutorial program, MEDLEARN, which gives new users some experience operating typical computer terminals (how to backspace, cancel commands, interrupt the MEDLINE mainframe computer's searches, etc.). Two large users' manuals are also provided. These give information about operational procedures, and also list the index terms.

Many medical and research libraries also provide a MEDLINE-trained person, called the Technical Information Specialist (TIS), to help with searches. The TIS may sit with the user while the search is carried out, giving advice. Or the user might submit a search topic to the TIS, and have the TIS carry out all the computer operations.

A user thus has the choice of three ways of using MEDLINE: 1) an unassisted search; 2) an assisted search, where a TIS is present for advice; and 3) a submitted search where the TIS does all the computer interaction.

The Study Objectives

In 1980, NIH instituted an evaluation study of MEDLINE, focussing on its usefulness to professionals in communication disorders. Of particular interest were the determinants of usage

of the service. Factors such as job category, information needs, experience with computers, etc. were to be examined to determine why some professionals used the MEDLINE service heavily, while others did not. Other evaluations of MEDLINE were also to be made, but those will not be discussed here.

The evaluation project began in September, 1980 and continued until March, 1983. The initial six months were devoted to developing a questionnaire to gather information about potential users, and to administering this questionnaire and training the potential users in MEDLINE procedures. The next 18 months were spent monitoring MEDLINE usage, and the final six months were used to process the data gained during the monitored usage phase.

The evaluation project was carried out at five locations in the United States. A MEDLINE center was established at each location, and a full-time TIS was provided for each center. However, the data reported here were collected at the University of Connecticut only. The full final report, with data from all five centers, will be published shortly by the National Institutes of Health.

Study Procedures

The Sample. The potential user population at the University of Connecticut MEDLINE center consisted of 166 professionals in Language Pathology (36% of the total group), Speech Pathology (24%), Audiology (8%), with the remaining 32% spread among specialties such as Aural Rehabilitation, Psychoacoustics, Otolaryn-

gology, etc. The group included practicing professionals as well as students pursuing advanced degrees (a little less than 22% of the total potential user group were students). This population was recruited primarily during the initial six month start-up period, and during the first 12 months of the monitored usage period.

Pre-Use Questionnaire. Before any searching was done, the user was asked to fill out an extensive pre-use questionnaire. This 13-page self-administered questionnaire contained questions in the following areas:

1. Job Profile. Questions in this section included primary and secondary job interests, highest degree granted, percentage of time spent in different job settings, such as clinics, hospitals, universities, etc.

2. Information Needs. Potential users were asked how frequently they needed updates from various sources of professional information such as journals, books, continuing education, etc.

3. Current Use of Information Sources. Respondents were asked how frequently they used each source of information to keep current and for comprehensive reviews of their area of speciality.

4. Satisfaction with Information Sources. The respondent's satisfaction with each source of information was recorded on an 8-point Likert-type scale.

5. Experience with Automated Information Systems. Each potential user was asked about prior experience with other bibliographic data base systems such as ERIC (Educational Resources Information Center), BRS (Bibliographic Retrieval Services), Lockheed Info Systems, etc. Both frequency of prior use and satisfaction with the system were recorded.

6. Beliefs about Computers and Automated Information Systems. Fourteen items, listed in Appendix A, were developed from the literature and from pilot interviews with potential users during the initial six-month period of the study. Each item represents a different belief, with no theoretical rational linking items, so each question was initially treated as a single indicator item in the data analysis.

7. Physical Difficulty in Using the Service. Potential users were asked to estimate the travel time in minutes to the MEDLINE center.

Post-Search Questionnaire. Each potential user who actually carried out a search was asked to fill out a short questionnaire immediately after completing the search. This questionnaire recorded the search mode (Unassisted, Assisted, or Submitted), the number of references generated, the user's satisfaction with these references, and the user's satisfaction with the TIS's help, if appropriate.

Post-Use Questionnaire. Each potential user who actually carried out a search filled out a post-use questionnaire which

contained items in the above 6 categories identical (or nearly so--some minor changes were made in the wording of some items by request of the project director) to those in the pre-use questionnaire. This permitted some before-after comparisons. Potential users who did not carry out a search were asked to fill out an abbreviated questionnaire, containing some of the pre-use questions which allowed them to serve as a pseudo-control group for some analyses.

An additional question was asked of users in the post-use questionnaire:

8. Type of Training Received. Three types of training were available: Workshops, given at periodic intervals, TIS individual training sessions, available by appointment, and training by other MEDLINE users. Each user was asked to indicate the primary type of training received.

RESULTS

Users vs. Non-Users.

Of the 166 potential users, 126 actually carried out one or more on-line searches. Thirty-eight did no searching, and two did not complete the questionnaire sequence sufficiently to permit their inclusion in the data analysis.

Chi-square statistics based on cross-tabulations (for non-quantitative indicators) or t-tests (for quantitative indicators) were used to determine which indicators in the eight question-

naire areas were significantly related to the decision to become a user or non-user of MEDLINE's services.

The data are most striking for their lack of predictive power. Only one interest area, Speech Pathology, had a slightly higher percentage of non-users than the other areas. Those with degrees granted before 1966 or after 1976 were slightly more likely to use the service, but these groups are also the ones in which academic faculty and students are most likely to fall.

The kinds of job tasks carried out by the respondents, the type of MEDLINE training received, and the travel time to the MEDLINE center showed no ability to discriminate between users and non-users. The appeal (and lack of appeal) of MEDLINE showed no evidence of being produced by differences in job requirements, training, or the difficulty in reaching the service. Neither did any of the opinion items about computer systems predict use/non-use.

In fact, the only item to clearly discriminate users from non-users was the frequency with which the respondent needed updates from journals, with those with higher frequency needs being much more likely to be users ($t=2.40$, $p<.02$).

The dominant predictor was thus none of the items relating to ease of use, familiarity with computer systems, beliefs about computer systems, or training, but it is a rather important one: whether the respondent had a need for the primary service provided by the computer-based communication system.

Amount of Searching Done by Users

The object of this analysis was to identify factors which discriminated users who carried out a number of searches from those who carried out few or no searches. Linear regression was used to predict the number of searches from a set of indices which were constructed to summarize the individual indicators into more abstract variables. The constructed indices were:

Total Frequency of Update (TOTUP). This index was constructed by summing the responses to the 8 categories of information needs in the pre-use questionnaire. It represents the respondent's total need for current information from all sources.

Total Information Usage (TOTINT). This index was constructed by summing the frequency of usage responses in the 12 information source categories of the preuse questionnaire. These responses were weighted as follows, before summing:

"Every couple of years"	= 1
"Annually"	= 2
"Every 3-6 months"	= 6
"Monthly"	= 24
"More than once a month"	= 48

Total Use of Information Bases (TOTUSE). This index was constructed by summing the number of times per year the respondent used automated information retrieval services as reported in the pre-use questionnaire. It thus represents prior experience with information retrieval systems.

Total Satisfaction with Sources of Information (TOTSAT). This index was constructed by summing the level of satisfaction reported by respondents for all 13 possible sources listed in the pre-use questionnaire.

In addition to these constructed indices, a number of individual variables were included as potential predictors of the level of searching carried out. All were taken from the pre-use questionnaire. They were:

-- The 14 computer and information system belief items (see Appendix A).

-- The number of minutes travel time to the MEDLINE center.

-- The year the highest degree was granted.

-- Type of training (from post-use questionnaire)
   a) workshop
   b) instruction from a friend
   c) by TIS

-- Professional interest in Speech Pathology (primary, secondary, or not at all)

Although some of these items did not discriminate between users and non-users, an examination of zero-order product-moment correlations indicated reasonably high covariance between the individual items selected and the number of searches carried out by an individual.

Stepwise regression was used in an exploratory analysis to identify the strongest predictors of the amount of searching done. Table 1 shows the results of this regression.

Four statistically significant predictors were found. In concert, they explain 12% of the variance in the number of sear-

ches. This figure is significant ($p < .001$). Each of the partial statistics for the individual predictors are also significant at $p < .05$. None of the additional predictors reached significance. In addition, a simultaneous regression which introduced all predictors in the same equation isolated the same four predictor variables as the only significant ones. Taken together, these results indicate that the four variables are the optimal set for predicting the number of searches carried out.

The variable with the strongest predictive power was the total information usage index (TOTINT). High information usage of other types of information sources was predictive of more frequent MEDLINE searches. Apparently there exists a group whose members are high consumers of information. This group is more inclined to use MEDLINE.

The second most predictive variable was one of the belief items:

"Playing with computers can be fun and personally satisfying."

Agreement with this item was predictive of a higher number of searches. It may reflect a positive orientation toward automated information systems, or perhaps it is reflective of the possible higher acquaintence of the high information consumers with computer equipment.

The third item was also a belief item:

"Computers, like most machines, always break down when you need them most."

Agreement with this item predicted more searches. This may be an unfortunate side-effect of reliance on a time-sharing computer system for critical information. Persons likely to do more searching are also those most likely to have been disappointed by equipment and system failures.

The last predictive item was the total satisfaction with sources of information (TOTSAT) index. The lower this index, the higher the number of searches the respondent was likely to carry out. Apparently those dissatisfied with more traditional sources of information will use newer services such as MEDLINE to seek satisfaction.

CONCLUSIONS

In this exploratory study, we reach the conclusion that the best predictor of initial use of a computer-based information service is a felt need for the information supplied. We find no evidence of the predictive power of prior experience, personality or belief variables, or even the extensiveness of training received.

A composite picture of the more frequent user of MEDLINE emerges from the analysis of those who actually made the decision to use the service. He/She is a high consumer of information, but one who is somewhat dissatisfied with current sources of information. He/She regards computer equipment positively, but is frustrated by unreliablity in the systems.

To the degree that the user population described in this paper is representative of other task-oriented professionals who are not primarily interested in computers, but in the information which they can provide, we may draw some tentative conclusions:

1) Any computer-based information service must provide information directly related to the jobs carried out by the professionals. If they do not recognize the need for the information service, they will not even sample the service. If the potential user population is merely unaware of the value of the system, an educational program might be called for. But if the service cannot easily be shown to be valuable to the current tasks being carried out by the professionals, it is unlikely to be accepted.

2) Those who really see the need for the service will use it despite inconveniences, and they will use it even if they have had little or no prior experience with computer systems.

3) Increasing the reliability and availability of the information service will increase use of the system.

4) Increasing computer literacy and decreasing fear of computing machinery by educational programs should increase use of the information system.

TABLE I

NUMBER OF USES OF MEDLINE PREDICTED BY USER CHARACTERISTICS

Predictor Variable	Beta Weight	F for Beta	Sig.
Total Information Usage (TOTINT)	.232	7.57	< .01
Total Satisfaction with Sources of Information (TOTSAT)	- .183	4.67	< .05
"Playing with computers can be fun..." (Agree)	.215	6.98	< .01
"Computers ... always break down just when you need them" (Agree)	.186	5.37	< .025

d.f. for Betas = 1;149

Multiple R = .343

F for Regression = 4.87 (4;146 d.f.) p < .001

APPENDIX A

BELIEFS ABOUT COMPUTERS AND AUTOMATED INFORMATION SYSTEMS

1. Computers are expensive pieces of sophisticated equipment that should be utilized only by trained experts.

2. Recent technology has made computer operation so simple even a layman can put them to good use.

3. Computers may be good for other people, but I personally have no need to use one.

4. In today's society, everyone should know how to operate a computer.

5. If I use a computer, I am afraid I might damage it.

6. Computers, like other machines, always break down just when you need them most.

7. It takes too long to learn to use a computer for it to be useful to me.

8. Computers are detrimental because they reduce creative thinking and restrict human development.

9. Playing with computers can be fun and personally satisfying.

10. Having a computer-based information system available provides Communication Disorder Specialists with an additional, useful tool.

11. Having a computer-based information sytem would provide me with an additional useful tool in my profession.

12. Computers are beneficial because they save time and give professionals greater freedom to investigate new ideas.

13. Computer systems and languages are just too complicated to use for relatively simple jobs like reviewing professional literature.

14. Computer information systems reduce the danger that I will be unaware of an important advance in my speciality.

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Answered on an 8-point scale, ranging from 1=DISAGREE to 8=AGREE

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